Space Weather Technical Forecast

Issued on Saturday, 08 April 2023 at 01:15 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-class flares (R1-R2; Minor-Moderate radio blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with the largest flare a C5.8 event at 07/2335 UTC most likely from AR3272. There are currently two sunspot regions on the visible disc, with AR3266 looking to have faded to plage as it approached the limb. AR3272 (Beta/Eai) in the far southeast is the current largest region on the visible disc. There has been continued growth in the region in recent hours, with small positive polarity spots developing close to the larger negative leader and intermediate spot development. AR3270 (Beta/Eso) near the southwest limb appears generally stable with little change as it rotates towards the limb.

Around 07/0800 UTC a modest-sized filament lifted off from an area around S35W00. Although the liftoff does not appear particularly energetic, there may be an Earth-directed component given its location along the Earth-Sun meridian. We await model data in order to assess if the associated CME may become geo-effective. No other Earth directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind as observed by DSCOVR at L1 have remained Slow-Ambient to Slightly Elevated, around 400-420km/s. Density has mainly been at Below Average levels, with only brief increases to Average during the period. Magnetic field strength, Bt, has been Weak throughout, below 8 nT, with the north-south component, Bz, also varying weakly between +5/-6 nT. The Phi angle has been mostly negative (towards the Sun). Geomagnetic activity has been Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV), as measured at GOES16, has been at Background levels. The high energy electron flux (greater than 2MeV), as measured at GOES16, reached a diurnal peak of 1008pfu at 07/1700 UTC. Electron fluence was at Active levels to star the period, but displays decreasing trend falling below the active threshold by the 07/1500 UTC observation. 3.48e7 integrated pfu fluence was recorded at 08/0001 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be generally Low, but with a chance of Moderate activity, most likely from AR3272 currently in the southeast. Other regions may emerge across the northeastern limb during the period to potentially supplement the existing flare risk.

Solar Wind / Geomagnetic Activity: A filament eruption around 0800 UTC on 07 Apr from approximately S35W00 is awaiting model output to determine if there is an Earth-directed component. Otherwise, there are no Earth-directed CMEs currently expected. Wind speeds are

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likely to mainly be at slow-ambient to slightly elevated levels during the period, but could increase to Elevated levels into Day 4 (11 Apr), given the possible connection to a coronal hole HSS.

Geomagnetic activity is expected to mainly be Quiet to Unsettled, with a slight chance of Active periods or G1/Minor Storm intervals into Days 3 and 4.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) is at background levels and is likely to remain so in the absence of significant flare activity. Electron flux values are likely to continue to show a diurnal cycle between Background and Moderate or perhaps High levels. Following a period of more active electron flux and fluence, a more steady-state condition is anticipated in the coming days. Active (greater than 1e8 integrated pfu) electron fluence is expected to remain below the threshold for the remainder of the forecast period.

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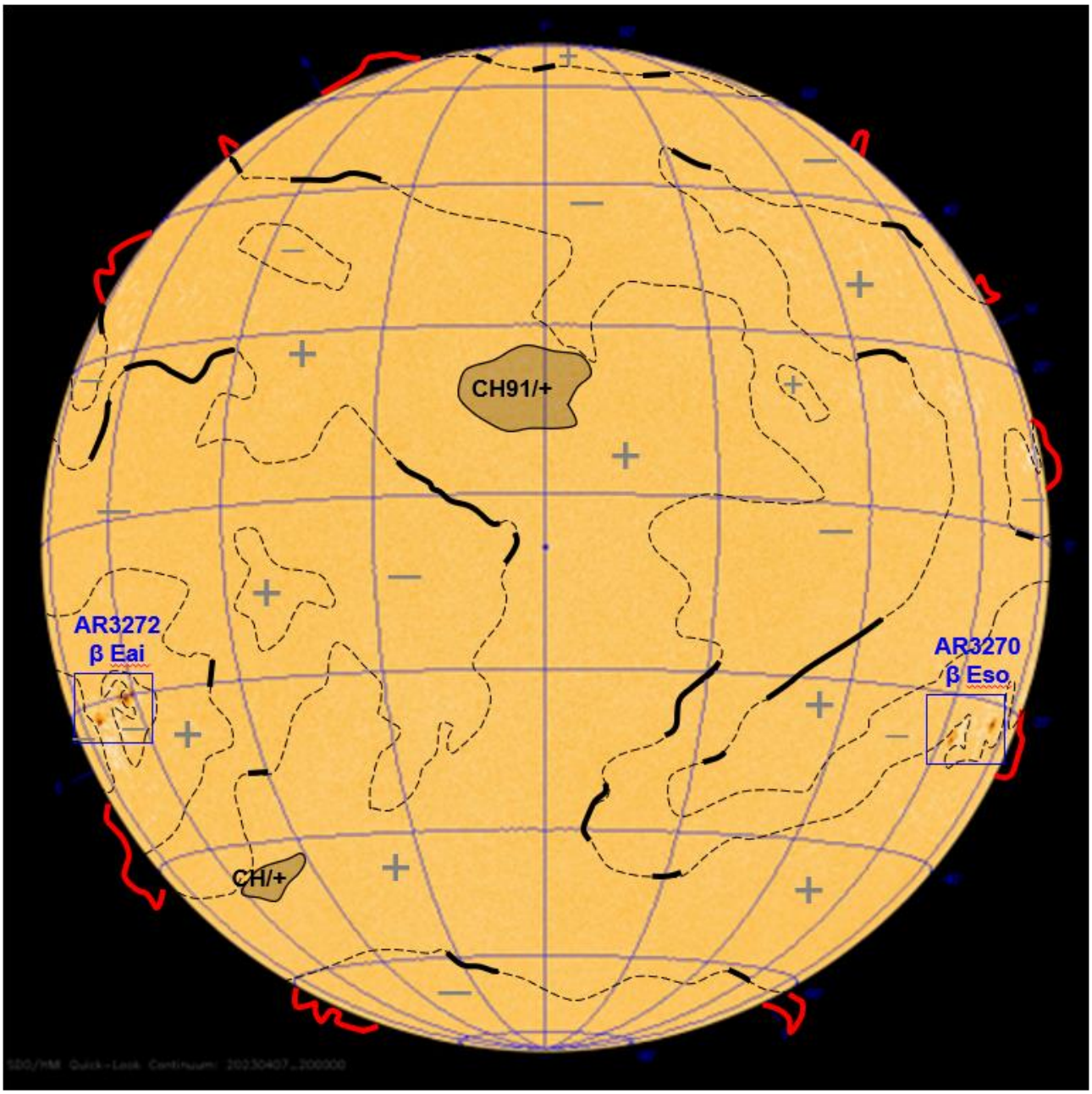
Figure 1. Solar Analysis Valid 07/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Around 07/0800 UTC a modest-sized filament lifted off from an area around S35W00. Although the liftoff does not appear particularly energetic, there may be an Earth-directed component given its location along the Earth-Sun meridian. We await model data in order to assess if the associated CME may become geo-effective. No other Earth directed CMEs have been observed in available imagery.

The recent HSS influence has now faded, with wind speeds fluctuating between Background and Slightly Elevated levels. In the absence of any CMEs influence wind speeds are expected to return slowly to slow-ambient levels into the start of the period.
A high-speed stream (HSS) associated with CH91/+ may begin to influence the solar wind regime as early as Day 3 (10 Apr) but more likely into Day 4 (11 Apr). Recurrence of this feature would suggests peak speeds into the Slightly Elevated range of between 450-500km/s are most likely to occur. The coronal hole is positive, which is not favored for a strong connection nor geomagnetic response close to the March equinox, this in combination with the position of the coronal hole in the northern hemisphere suggest only a low probability of significant geomagnetic response.

Geomagnetic activity is therefore expected to be generally Quiet to Unsettled, with a chance of Active periods from Day 3 given the possible connection to the HSS of CH91/+. There is an associated very slight increase in the probability of a Minor Geomagnetic Storm/G1 interval. Probabilities may change for the latter part of the forecast period in subsequent issues of this briefing if the CME still to be assessed contains an Earth-directed component.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	5	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity – Earthbound Coronal Mass Ejections

Nil.

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Radio Blackouts - X-Ray Flares:
There are currently two sunspot regions on the visible disc, with the small AR3266 looking to have faded to plage as it approached the limb.

AR3272 is now the largest and most complex region, and there has been continued slight growth in the region as it rotates into clearer view in the far southeast, with small positive polarity spots developing close to the larger negative leader and continued intermediate spot development. AR3272 now provides the majority of the flare risk into the period as AR3270 in the southwest appears generally stable with little change as it rotates towards the limb. There has been some filament disruption in the vicinity of this AR3070 however, and an increase in magnetic complexity cannot be ruled out before it will rotate off of the visible disc into Day 2 (9 Apr).

A bright region visible on STEREO-EUVI/195 imagery suggests that a new region may emerge across the northeastern limb and onto the visible disc early in the period, though in general no significant returning active regions expected.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	25	25	25
Very Active	R3 to R5 X Class	No	5	5	5	5

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Solar Radiation Storms - (High Energy Protons):
High energy proton flux (greater than 10MeV), as observed by GOES-16, is most likely to remain at Background levels pending any significant flares, with the risks just slightly elevated by the two fairly large active regions currently on the disk.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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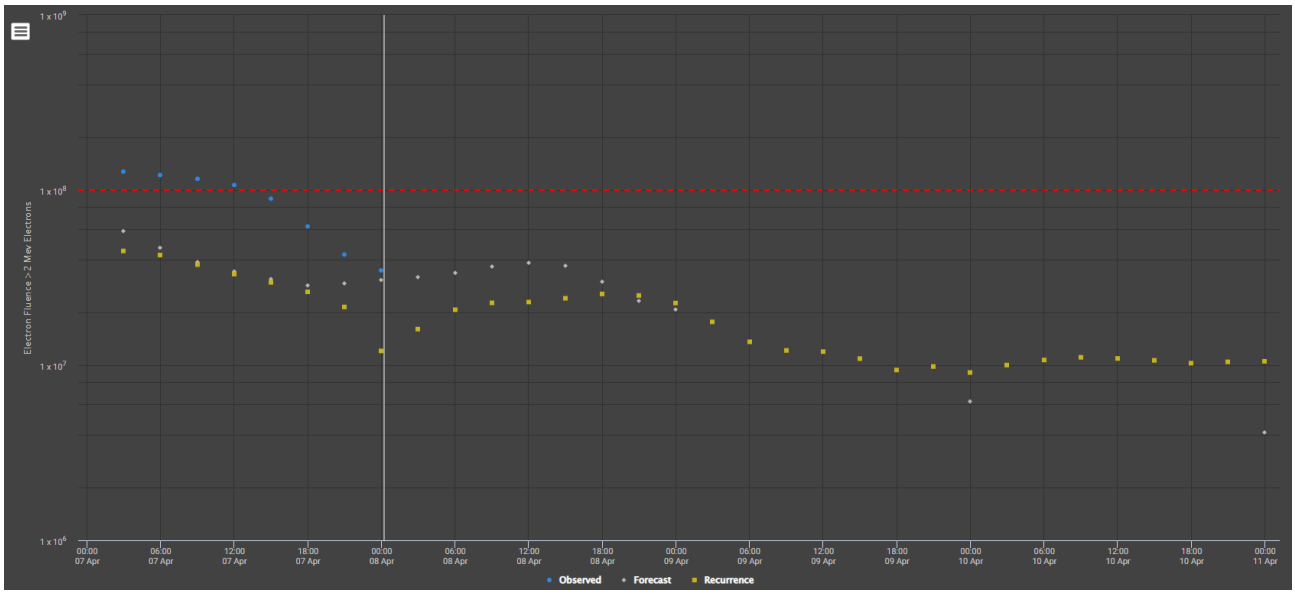
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) is forecast to continue to diurnally oscillate between Background and Moderate or perhaps briefly High levels through much of the forecast period. Any connection to the HSS of CH91/+ into Day 3 or 4 (10-11 Apr) is likely to see electron counts fall, owing to increased Geomagnetic activity and suppression of the Van Allen electron belts.

Electron fluence has recently fallen below the Active threshold, and is expected to remain below though the period as the electron belts assume a more steady state, with the MOSWOC REFM model viewed as generally good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	20	10	10	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 2: Latest Met Office REFM model output.



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